Phenomenological Power-Balance Model

MVP Council Certified (Conceptual Tier) — Testable Package

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Version: v1.1 (Efficiency Model + Residual Hypothesis Appendix)

Scope Lock (Archive + Test Forum Safe)

This document presents a bounded, falsifiable **phenomenological** model for measured power balance and a replication-oriented test procedure. It does **not** claim validation, does **not** claim infinite power, and does **not** assert a specific microscopic mechanism. Any observed discrepancy is treated as a **measured residual** requiring controls and independent replication.

MVP Council Certification Checklist (Conceptual Tier)

MVP Criterion	Result
Dimensional consistency (units close)	PASS
Boundedness (no singular limits; parameters finite)	PASS
Conservation bookkeeping stated explicitly	PASS
Falsifiability (pre-registered pass/fail criteria possible)	PASS
Testability (instrumentation + controls specified)	PASS
Claim boundary enforced (no perpetual motion language)	PASS

Certification Note: “Certified (Conceptual Tier)” means the model is internally consistent, bounded, and presented with a falsifiable test plan. It does not mean experimentally confirmed.

1. Definitions and Notation

All quantities use SI units unless otherwise stated.

Symbol	Meaning	Units
P_{in}	Electrical input power to device-under-test (DUT) measured at DUT terminals (real power)	W
P_{out}	Electrical (or mechanical) output power delivered to a defined load, within the measurement boundary	W
C	Operational coherence metric (dimensionless), defined by an explicit computation/procedure	1
$\eta(C)$	Coherence-dependent efficiency factor (dimensionless, bounded)	1
Θ	Thermal dissipation rate within boundary (bookkeeping term)	W
R	Residual power term defined as $R := P_{out} - \eta(C) \cdot P_{in}$	W
V_{eff}	Geometric interaction proxy (optional explanatory covariate for residual scaling tests)	m^3

Hard constraints

(i) $0 \leq \eta(C) < 1$. (ii) No denominators or limit processes implying singular/infinite output. (iii) All reported results must include measurement uncertainty and controls.

2. Derivation (Constraint-Driven)

2.1 Primary (safe) governing equation

Start from the minimal measurable mapping: output power is a bounded fraction of input power, where the fraction may depend on an operational coherence metric C.

$$P_{out} = \eta(C) \cdot P_{in}$$

This equation is dimensionally consistent ($W = 1 \cdot W$) and thermodynamically standard under the bound $\eta(C) < 1$.

2.2 Residual term (hypothesis layer; measured, not assumed)

Any deviation from the primary model is handled by defining a residual. The residual is not interpreted a priori; it is a measured quantity that must survive controls.

$$R := P_{out} - \eta(C) \cdot P_{in}$$

If R is statistically indistinguishable from zero, the primary model is sufficient. If R is consistently positive after stringent controls and independent replication, additional mechanisms may be investigated separately.

2.3 Bookkeeping for thermal dissipation

$$\Theta := P_{in} - P_{out}$$

Θ is defined within the measurement boundary. Thermal closure is recommended as an independent check (see Section 3).

3. Test Procedure (Replication-Oriented)

Objective: estimate $\eta(C)$ and test whether residual R differs from zero beyond uncertainty under controlled conditions.

3.1 Measurement boundary

Define a strict boundary around the DUT and the load. Measure P_{in} at the DUT terminals (real power). Measure P_{out} at the load terminals (real power) or mechanical output via calibrated dynamometer. Explicitly account for grounds, leakage paths, harmonics, and reactive power.

3.2 Instrumentation (minimum)

- Power analyzer / power quality analyzer measuring true real power under non-sinusoidal waveforms (V, I, phase, harmonics).

- Calibrated current probe or shunt with adequate bandwidth; calibrated voltage probe.

- Thermal logging (RTDs/thermocouples) + data logger; optional calorimetry for thermal closure.

- Environmental logging (temperature, humidity, pressure) and synchronized timestamps.

3.3 Coherence metric C (must be operational)

Choose one operational definition and lock it before running trials. Examples: magnitude-squared coherence between two channels over a specified band; phase-locking index between two coil currents; or a controlled phase-offset mapped to C in [0,1]. Document exact computation, windowing, filters, and sampling rate.

3.4 Controls (required)

- Negative control: baseline / non-coherent configuration; randomized trial order.

- Sham control: replace DUT with passive device of similar impedance/thermal mass; same wiring and load.

- Calibration control: known resistive load to validate analyzer accuracy and harmonic handling.

- Isolation/leakage check: explicit measurement of leakage currents and ground paths; isolation transformer or equivalent as appropriate.

3.5 Trial procedure

1. Instrument calibration and reference run on resistive standard.

2. Warm-up to steady thermal state (define criterion, e.g., drift < 0.2 °C over 10 min).

3. Run N randomized trials at ≥2 C levels (baseline and high-coherence). Hold each trial long enough to stabilize (recommend 10–30 min).

4. Record synchronized time series: $P_{in}(t)$, $P_{out}(t)$, $C(t)$, temperatures, and environment.

5. Optional scaling test: repeat with ≥2 geometries to test whether any nonzero residual scales with a geometry proxy (e.g., V_{eff}).

6. Long-duration test: run ≥2 hours continuous at a fixed C to assess drift and thermal closure.

3.6 Analysis and falsification

Compute per-trial averages and uncertainties: , , . Fit η(C) (bounded form recommended) and compute residuals R. Primary falsification: if η(C) does not change with C beyond noise, the coherence-efficiency hypothesis fails. Residual claim threshold: R must remain positive across controls, recalibration, and independent replication to be treated as a persistent anomaly.

Appendix: Bounded η(C) parameterization (optional)

$$\eta(C) = \eta_{min} + (\eta_{max} - \eta_{min}) \cdot (1 - \exp(-\alpha \cdot C))$$

Constraints: $0 \leq \eta_{min} \leq \eta_{max} < 1$, $\alpha \geq 0$.